SPACE OPERATIONS SYMPOSIUM (B6)
New Operations Concepts and Commercial Space Operations (2)

Author: Mr. Marc Niezette
Telespazio VEGA Deutschland GmbH, Germany, marc.niezette@telespazio-vega.de

Mr. Alexander Hoffmann
Telespazio VEGA Deutschland GmbH, Germany, alexander.hoffmann@vega.de
Mr. Robin Steel
VEGA Space, Germany, robin.steel@vega.de
Dr. Marco Roveri
Italy, roveri@fbk.eu
Dr. Alessandro Cimatti
Italy, cimatti@fbk.eu
Mr. Konstantinos Kapellos
Belgium, konstantinos.kapellos@external.trasys.be
Mr. Nicola Policella
ESA, Germany, nicola.policella@esa.int
Mr. Alessandro Donati
European Space Agency (ESA), Germany, Alessandro.Donati@esa.int

ON-GROUND PLANNING FOR AUTONOMOUS ROVER OPERATIONS

Abstract

In the last decades, ESA has significantly increased the level of automation of their spacecraft, going for instance from time-tagged-based commanding to event-based commanding for EO missions. Exploration missions such as Rosetta or Mars-Express still rely exclusively on time-tagged on-board commanding, even though the mission planning produces event-based schedules that are converted to time-tagged ones late in the programming chain. In both cases this automation relies on the high predictability of the environment specific to spacecraft.

ESA is preparing today for future Rover missions where the interaction of the system with its environment mission would benefit from a significantly higher level of autonomy from the ground. This would allow ensuring safety of remote systems, increasing the complexity of the missions requiring more powerful (sub)systems capable of adapting to a wider range of inputs and situations, and improving mission return in an opportunistic manner.

In this context, VEGA Space performs the Innovative Rover Operations Concepts – Autonomous Planning (IRONCAP), an ESA study project to explore and define the concepts, techniques and interactions needed to control and plan the activities of an interplanetary rover.

An essential issue to be addressed in the study is the definition of the rover-specific planning cycle, the specification and prototyping of the tools that will support the rover planning, and the integration of the concept and tools within the general operations concept and infrastructure available at the European Space operations Centre (ESOC) of ESA in Darmstadt. Essential on-ground issues to be considered are the support to the situational (science and engineering) assessment of the last activity period of the rover, the definition of science and engineering goals, the operations planning in-line with the level of autonomy of the rover, plan validation, and plan refinement. The tools will include activity planners and simulators. The integration in the ESOC environment require identifying specific interfaces to components

of the ESOC infrastructure, for instance for supporting the telemetry and data processing required for situational assessment, command upload, etc.

The paper will concentrate on the analysis of the operations concept, the description of the tools, and the presentation of the integration of the rover control system in the ESOC infrastructure.